

A METHODOLOGY TO STUDY THE COMPLEXITY OF BUILDABILITY IN CONSTRUCTION PROJECTS: PHENOMENOLOGICAL RESEARCH PERSPECTIVE

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ABSTRACT

The construction industry is crucial to the economic development of any nation. However, the achievement of the project objectives has become challenging in the construction industry. Thus, research on improving the construction project performance is often appealed. One of the reasons for poor performance in the construction industry has been identified as lack of buildability. Buildability is expected to give a boost to construction project performance throughout the entire project life cycle. Even though the existing knowledge domain suggests various buildability guidelines, appraisal systems, and concepts targeting different phases or different elements of construction, there is no established set of practices or directives that can be incorporated into a construction project throughout its various stages to improve construction project performance. This is mainly due to the absence of clear identification of the deep meaning of the key drivers of the buildability concept. Therefore, it is important to obtain a clear picture of the key drivers of this concept.

This challenge may be handled by obtaining perception from the industry experts with regard to their lived experience concerning buildability. This paper utilises works of literature related to research methodology to design a suitable research framework for this study. The research onion model was adopted for the framework development and phenomenological philosophy was proposed with Interpretative Phenomenological Analysis (IPA). The paper highlights the importance of adherence to micro-interactions and a systematic approach to research work throughout the research process to maintain the quality of the study.

Keywords: *Buildability; Lived Experiences; Phenomenology; Phenomenological Research.*

1. INTRODUCTION

The construction sector plays an important role in the socio-economic development of any country. Thus, the construction industry is undeniably essential to the growth of a nation and a key sector in the nation's economy (Ibrahim, et al., 2010). In addition to

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economic considerations, the impact of the success rate of constructions spread across various other societal goals such as sustainability, carbon reduction, risk reduction too. Therefore, the successful achievement of project objectives in the construction industry is paramount. A construction project is commonly acknowledged as a successful project when the aim of the project is achieved in terms of predetermined objectives of completing the project on time, within budget, and to the required quality standard (Kesavan, et al., 2015; Naoum and Egbu, 2015). To achieve this goal, construction companies should complete the projects within their anticipated budgets, durations and expected quality targets (Polat, et al., 2014). However, in most construction projects severe time and cost overruns occur due to various factors (Venkateswaran and Murugasan, 2017; Habibi and Kermanshachi, 2018; Ogbu and Adindu, 2019; Johnson and Babu 2020). Poor quality in construction projects has also become a common phenomenon in the world (Ali and Wen, 2011; Buba, et al., 2020).

The root causes of these issues have been identified as poor cost estimation, lack of design integration, extensive number of change orders (Rosayuru, et al., 2019; Johnson and Babu 2020), lack of effective communication (Johnson and Babu, 2020; Kwofie, et al., 2020), poor selection of procurement method (Farrell and Sunindijo, 2020; Johnson and Babu, 2020), and lack of buildability (Jergeas and Put, 2001; Farrell and Sunindijo, 2020; Johnson and Babu 2020). Among these causes, lack of buildability has been identified as a key factor that even directly or indirectly impacts on the other issues as well (Nascimento, et al., 2017; Ansyorie, 2019; Al-Fadhli, 2020; Khatib, et al., 2020). This is because buildability impacts throughout the construction projects, starting from conceptual planning, throughout the procurement processes, construction methods, and also involving stakeholders in the decision-making to achieve their satisfaction (Ansyorie, 2019; Al-Fadhli, 2020; Samimpey and Saghatforoush, 2020). The framework shown in Figure 1, which was named “the wider framework of buildability”, illustrates the impact of buildability throughout the entire project work stages.

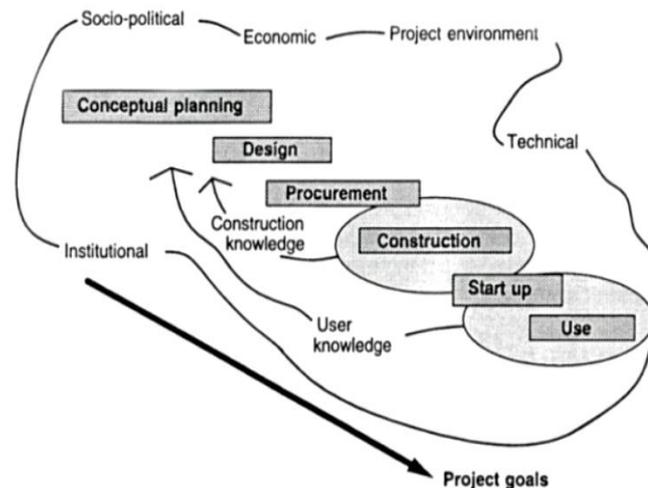


Figure 1: The wider framework of buildability

Source: Construction Industry Institute Australia - CIIA (1993)

The benefits of implementing buildability were multi-faceted. Research performed in this field have shown that buildability is effective in reducing time and cost and improving projects' quality throughout the various phases of the construction project cycle (Jergeas and Put, 2001; Lam and Wong, 2009). Agreeing to this, Samimpey and Saghatforoush (2020) stated that buildability has reduced additional processes and prevented duplications, and thereby has reduced final costs of projects and their delivery time. Therefore, integrating buildability into construction projects can lead construction projects to fruitful outcomes not only in every aspect but also throughout their work stages.

Buildability is a concept deals with the optimal integration of construction knowledge and experience at various project stages to achieve the overall project goals (Naoum and Egbu, 2016). Interestingly, a significant contribution in relation to buildability research is made by various industry research institutes such as Construction Industry Research and Information Association (CIRIA) in the UK, Construction Industry Institute Australia (CIIA) and Construction Industry Institute in United States (CIIUS). CIRIA in 1983 first defined buildability as “the extent to which the design of a building facilitates ease of construction, subject to the overall requirements for the completed building”. Since then, numerous studies have been conducted targeting various phases and aspects of construction projects to strive for better project performance through improving buildability. For example, buildability assessment model by Building and Construction Authority (BCA) in Singapore, guidelines for improving the buildability of building designs by CIRIA, concepts to improve buildability introduced by CIIUS have provided guidelines for designers to use at the early design stage to improve buildability in construction projects. Adding to these, buildability principles introduced by Adams (1989), CIIA (1996) and buildability concepts introduced by Nima, Abdul-Kadir, Jaafar and Alghulami (2001) have attempted to cover beyond the design phase of a construction project.

It has to be noted that these generic explanations, guidelines, concepts, and various definitions that have been emerged over time have fostered the concept of buildability towards better construction performance. Our previous study conducted specifically on various definitions of buildability and its key constructs has illustrated the numerous definitions that emerged over three decades. This study concluded that the key constructs of buildability include “integrate construction knowledge and experience”, “throughout the project delivery process” to “achieve overall project objectives” (Wimalaratne, et al., 2021). However, a detailed interpretation of these constructs as to what it means in-depth and what to be practically done in each work stage to benefit from it is not adequately explored. Hence, much deeper insight is necessary in relation to these key constructs for further investigating this concept and to develop a practical application that was found profoundly missing in the existing knowledge domain. Therefore, the aim of this study is to investigate the deeper meaning behind the key constructs of buildability leading to its practical application to enhance construction project performance.

Provided that buildability is a concept born and brought up within the construction industry and continues to serve the industry itself, obtaining an industry point of view on this concept to understand the driving principles that come under each key construct is needed. Thereby a clear mechanism could be derived that can practically implement to improve construction project performance throughout the entire project duration. Therefore, it is worth researching to establish the industry point of view on buildability

before exploring ways of integrating buildability into construction projects. Accordingly, the aim of this paper is to design the research methodology for understanding the deeper meaning of the key constructs of buildability by understanding the practical experience of the industry experts. This paper addresses the research methodology which is required to obtain an in-depth view of the buildability concept based on the research aim.

2. THE RESEARCH METHODOLOGY

Research is a well-coordinated activity aiming to contribute more knowledge to the existing body of knowledge (Fellows and Liu, 2008). Therefore, the construction of new knowledge and explorations of the existence of realities require a specific method of inquiry (Collins and Hussey, 2014). In this regard, there are different frameworks proposed by various researchers to decide upon a research methodology. These frameworks are comprised of different components to be included in a research design. For instance, Kagioglou, et al., (2000), introduced a framework comprising research philosophy, research approach, and research techniques. (Creswell and David Creswell, 2018) introduced a framework interconnecting philosophical worldviews, strategies of inquiry, and research methods. Saunders, Lewis, and Thornhill (2019) introduced another popular framework comprising six (06) components as research philosophy, research approach, research methodological choice, research strategy, research time horizon and research techniques and procedures. According to these popular frameworks, philosophies (Saunders, et al. 2019), philosophical worldviews (Creswell and David Creswell 2018) and research philosophy (Kagioglou, et al., 2000) represent similar meanings, which basically described the fundamental assumptions in relation to the “reality”. Guba and Lincoln (1994) and Healy and Perry (2000) introduced these as “research paradigms” and stated that they can be used to position the relationship between the world and the researcher. Likewise, strategies (Saunders, et al., 2019) strategies of inquiry (Creswell and David Creswell, 2018) and research approach (Kagioglou, et al., 2000) carried similar meanings. (Yin, 2018) explained this “research strategy” as the way of doing research. Further, Research techniques and procedures (Saunders, et al., 2019) research methods (Creswell and David Creswell, 2018) and research techniques (Kagioglou, et al., 2000) carried similar meanings. Each of these authors have described a range of options under these research techniques.

Therefore, the above frameworks contain similar steps required for effective research. In order to design the research methodology for this study, Saunder’s research onion (see Figure 2) was used as it was found more comprehensive compared to the other two frameworks.

The Saunders Research Onion illustrates the stages involved in the development of research work as a step-by-step process that can be adopted for almost any type of research methodology and can be used in a variety of contexts (Saunders, et al., 2019). Saunders, et al. (2019) recommend that their “Research Onion” be unwrapped starting from the outer layer towards the most inner layer and the right step from each layer to be selected based on the research. The research onion includes six main stages as below:

1. Research philosophy
2. Research approach
3. Research methodological choice
4. Research strategy

5. Research time horizon
6. Research techniques and procedures (data collection and analysis)

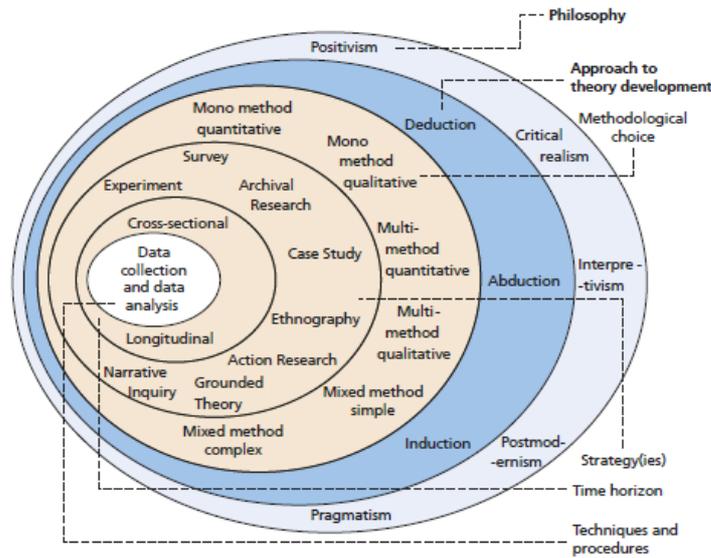


Figure 2: Research onion

Source: Saunders, Lewis, and Thornhill (2019)

Described herein are the detailed procedure designed to be followed in achieving the aim of this study.

2.1 RESEARCH PHILOSOPHY

The research philosophy term refers to a system of beliefs and assumptions about the development of knowledge (Saunders, et al., 2019). The researchers must be aware of the philosophical commitments they make through a research design, and failure to adhere to philosophical concerns can affect the quality of the research negatively (Easterby-Smith, et al., 2015). There are three (03) types of research philosophies/ beliefs and assumptions as axiology, ontology, and epistemology.

Axiology refers to the role of values and ethics (Saunders, et al. 2019). In axiology assumptions, the researcher will need to decide how they maintain both researcher's own values and those of the people who have researched in a particular area (Saunders, et al. 2019). Ontology refers to assumptions about being an existence or the nature of reality (Saunders, et al., 2019). Ontology embodies understanding “what is” (Gray, 2014) and the ontological assumptions researchers make throughout their study will shape how the researcher sees and study the research objectives (Saunders, et al., 2019). There are two approaches come under ontological assumptions. That is objectivism and constructivism. Epistemology on the other hand refers to the assumptions about the best way to study the world (Bhattacharjee, 2012). Epistemology embodies understanding “how to know the reality?”. Epistemology helps to relate to and understand the research of others and the choices that were made and build up the relationship between the researcher and the reality (Uma and Roger, 2016). There are two approaches that come under epistemological research. That is positivism and interpretivism. Positivism suggests that “reality” exists external to the researcher and can be explored through the rigorous process of scientific inquiry. Interpretivism underlines that humans are different from

physical phenomena for the reason that humans create meanings (Saunders, et al., 2019). Phenomenology is another research philosophy introduced by Edmund Husserl in the 19th century to study the experiences of humans. The founding principle of phenomenological inquiry is that experience should be examined in the way that it occurs, and in its own terms (Smith, Flowers and Larkin, 2009). Therefore, phenomenology has common features to interpretivism which highlights the human intervention in creating knowledge and supports enquiring epistemological problems in a new, fresh, and exciting manner (Moran, 2002). However, phenomenology goes deeper into human experience and studies what the experience of being human is like, in all of its various aspects, but especially in terms of the things which matter to our lived world (Smith, et al., 2009) and evokes in consciousness with reference to a specific experience (Moustakas, 1994). Therefore, major differences in phenomenological research can be identified as engagement in disciplined and systematic efforts to set aside prejudgments regarding the phenomenon being investigated in order to launch the study as far as possible free of preconceptions, beliefs, and knowledge of the phenomenon from prior experience and professional studies - to be completely open, receptive, and naive in listening to and hearing research participants describe their experience of the phenomenon being investigated (Moustakas, 1994).

Choosing the right methodology for a given research project can be an enormous challenge (Masadeh, 2012). Although there is no one best research philosophy, Philliber, Schwab, and Samsloss (1980) stated that research designs deal with what questions to study, what data are relevant, what data to collect, and how to analyse the results. Agreeing to this (Blessing and Chakrabarti, 2009) stated that the research methodology should be selected depending on the specific research question.

The purpose of this research is to create new, richer understandings and interpretations of social worlds and contexts on buildability within construction projects. Therefore, in this study, success is mainly dependent on human contribution and the study demands to understand and interpret deeper meanings of human experiences on buildability. Industry experts are considered as social actors in this study. The study attempts to interpret the world from these social actors' points of view by adopting suitable methods of inquiry rather than observing their behaviour. Phenomenology research philosophy sees social phenomena as socially constructed and is particularly concerned with generating meanings and gaining insights into those phenomena (Moustakas, 1994; Saunders, et al., 2009). The key value of phenomenological philosophy is that it provides us with a rich source of ideas about how to examine and comprehend lived experience (Smith, et al., 2009). The phenomenon studied in this study is buildability. Buildability concept has clearly identified key constructs that seem generic but demand a further investigation referring to knowledge as it appears to the consciousness of experts, which can be interpreted following the science of describing what one perceives, senses, and knows in one's immediate awareness and experience (Moustakas, 1994). Therefore, although this study bears the epistemological stance that humans are different from physical phenomena and create knowledge, this study goes beyond a general interpretivist's inquiry as it attempts a careful examination of human experience to find means by which someone might come to accurately know their own experience of a given phenomenon, and would do so with a depth and rigour which might allow them to identify the essential qualities of that experience (Smith, et al., 2009). Therefore, the research philosophy in this study is phenomenology.

2.2 RESEARCH APPROACH

There are three (03) research approaches as deduction, induction, and abduction. Deductive approach refers to the studies that start with a theory, often developed from reading the academic literature, and the researcher designs a research strategy to test that theory through the research (Saunders, et al., 2019). The inductive approach refers to the studies that start by collecting data to explore a phenomenon and generate or build theory such as conceptual framework (Saunders, et al., 2019). Abductive approach refers to collecting data to explore a phenomenon, identify themes and explain patterns, to generate a new or modify an existing theory (Saunders, et al., 2019).

In this study, literature survey identified the key constructs of the phenomena being studied (buildability). However, further investigation is required through data collection to further explore buildability. A deep identification and interpretation of the lived experiences gathered from the data collection will facilitate the construction of new knowledge. Even though each construction project is different in terms of the procurement process, contractual aspects, and nature of the construction itself, the sense of phenomenon being studied in relation to various construction project stages would be principally applicable and useful to be used in different circumstances of similar context. Therefore, this research will take abductive approach.

2.3 RESEARCH METHODOLOGICAL CHOICE

There are six (06) methodological choices discussed in Saunders research onion. They are, Mono method Quantitative, Mono method qualitative, Multi-method quantitative, Multi-method qualitative, Mixed method simple, and Mixed method complex.

First of all, the methodological choice for research should be whether to follow a quantitative method, qualitative method or mixed-method. Each element in research design should be based on the research question, objectives and show consistency with the research philosophy adopted (Saunders, et al., 2019). Saunders, et al. (2019) explained that one way of differentiating quantitative research from qualitative research is to distinguish between numeric data (numbers) and non-numeric data (words, images, audio recordings, video clips, and other similar material). This research requires in-depth inquiry on the studied phenomenon (buildability), which get the opinions of different people through their lived experiences in relation to the phenomenon being studied. Hence this study falls under qualitative methodological choice. A qualitative research design which use a single data collection technique, is known as a mono method qualitative study and a qualitative research design that uses more than one qualitative data collection technique is known as a multi-method qualitative study (Saunders, et al., 2019). This study will collect data using more than one qualitative data collection technique and corresponding analytical procedure. The selected data collection techniques in this research include expert interviews and case studies using a phenomenological approach. Therefore, the methodological choice of this research is multi-method qualitative.

2.4 RESEARCH STRATEGY

Qualitative research is associated with a range of strategies. Some of the principal strategies used with qualitative research are Action Research, Case Study Research, Exploratory Surveys, Ethnography, Grounded Theory, and Narrative Inquiry. The

suitability of these methods depends on the research objective and the philosophy which has been adopted for the investigation.

In this study, first in-depth expert interviews (Stage 1) will be used to collect data and establish conclusions in relation to buildability. Case studies (Stage 2) will use thereafter to further investigate the phenomena (buildability) and identify the gaps in the practice. Sample for the first stage of data collection will be individuals /industry practitioners who have extensive expertise around the world. Data related to the theoretical propositions will be collected at this stage considering the lived experience of the experts of all the phases of construction projects and throughout various orientations of their practice (i.e: contractor's practice, consultant's practice, project manager's practice). Therefore, research strategy is exploratory surveys.

Research strategy for Stage 2 will comprise case studies. Cases are the sources that lead the study into the identification of data to be collected. As per Yin (2018), there are two different steps to be considered when the cases are introduced to the research as (1) defining the case and (2) bounding the case. The "case" can be an individual, some event or entity other than a single person. The cases for this study shall be selected within Sri Lankan geography due to limitations of the research. Once the cases are defined, other clarifications such as bounding of the case is required. The bounding is expected to tighten the connection between the selected case, research questions and theoretical propositions (Yin, 2018).

As per Yin (2018), it is also important to define the specific time boundaries to define the estimated beginning and end of the case (i.e., whether to include the entire or only some part of the life cycle of the entity that will become the case). In this study, the cases will be selected from the nearly completed or recently completed building construction projects as this will facilitate the maximum exposure for the interviewers to explain their lived experiences.

The next step is defining the criteria for interpreting the findings. This criterion shall aid analysis of the data collected and guide the researcher suggesting what to be done after collection of the data. Yin (2018) stated that it is vital for the researcher to be aware of the choices available and how the choices might suit the selected case study which shall then create a more solid foundation for the later analysis. More details on the data analysis technique of the research are discussed under section 2.6 "Research techniques and procedures".

2.5 RESEARCH TIME HORIZON

Before data collection, it is important to determine whether the objective of the research is to study a phenomenon in a snapshot of time (cross-sectional) or study an ongoing phenomenon (longitudinal) (Saunders, et al., 2019). This research involves a particular phenomenon at a particular time. Therefore, the time horizon of the research is identified as cross-sectional method.

2.6 RESEARCH TECHNIQUES AND PROCEDURES

Data collection and analysis will be carried out following the phenomenological interview approach. Phenomenology is concerned with the systematic reflection and analysis of phenomena associated with conscious experiences, such as human judgment, perceptions, and actions, with the goal of; (1) appreciating and describing social reality from the

diverse subjective perspectives of the participants involved, and (2) understanding the symbolic meanings (“deep structure”) underlying these subjective Experiences (Bhattacharjee, 2012). The phenomenon used in this study is buildability. A comprehensive literature survey will be carried out concerning the academic literature and industry reports to understand the symbolic meaning of buildability and derive theoretical propositions.

Data collection and analysis will be carried out in two stages where stage 1 will be the in-depth expert interviews with experienced experts practicing in the construction industry. Stage 1 shall establish a deeper understanding of the expert’s opinion on buildability. Main data source is in-depth conversations with a small number of participants. Stage 2 will be based on the selected case studies using phenomenological interview approach. Stakeholders of the selected construction projects who are responsible for designing buildings, architects & engineers, and specialised experienced contractors will be the participants for the semi-structured interviews under stage 2.

There are two types of phenomenological interviews. They are 1. Descriptive and 2. Interpretive. This study will follow interpretive phenomenological approach where the researcher attempts to understand the hidden deeper meanings behind the phenomenon and interpret it using a suitable analytical technique (IPA) to explain the phenomena being studied. Researcher will bracket herself up to a greater extent in collecting rich insights and digging deeper into the meanings while preserving the authenticity of the lived experiences of the participants. Interpretive phenomenological interviews will facilitate active listening and non-interruption of participants while gathering data around two broad questions “what have the participant experienced in terms of the phenomenon” and “what contacts or situations have influenced the participant’s experiences of the phenomena”.

There are popular qualitative data analysis methods such as qualitative content analysis, narrative analysis, discourse analysis, thematic analysis, grounded theory and interpretive phenomenological analysis. Among these, Interpretive phenomenological analysis (IPA) is designed to understand the personal experiences of a subject (for example, a person or group of people) concerning a major life event, an experience, or a situation (Kerryn, 2020). Therefore, IPA will be used to analyse the data collected and to identify the gaps in the current practice and thereby reach the conclusions for this study.

2.7 RESEARCH METHODOLOGY FRAMEWORK

In the sections above the research philosophies and underlying assumptions, research approaches and research strategies are discussed in detail with reference to their mutual relationship. In the section below authors formulate an appropriate methodology to fulfil the aim of the research on obtaining the interpretations of the key constructs of the concept of buildability and thereby derive a practical framework to integrate buildability into construction projects.

In order to ensure the effectiveness of the methodological tool introduced below, a pilot study was carried out with an expert who had 16 years of experience in the construction industry. The objective of this pilot study was mainly to test the methodological tool so that the desired outcomes can be achieved under the main study. A semi-structured phenomenological interview was conducted. It was found that the emerging themes were in agreement with the literature findings, and several new themes suggesting integrating

buildability into construction project. The new themes were identified as new knowledge and therefore an original contribution to existing knowledge can be made.

Refer Figure 3 for the conceptual research methodology framework derived for this study.

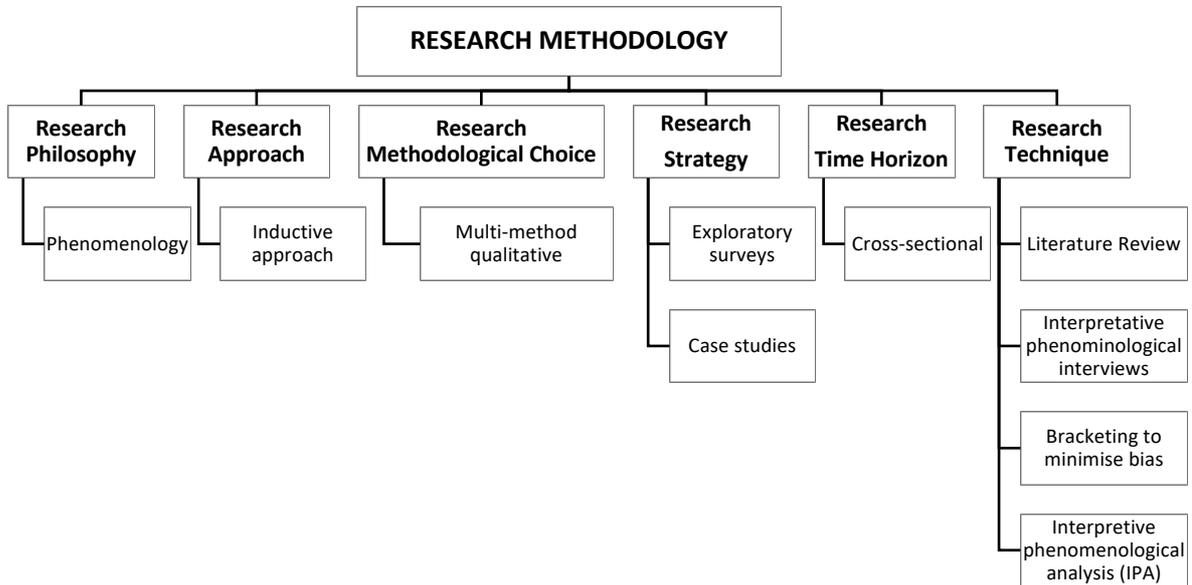


Figure 3: Conceptual research methodology framework

3. CONCLUSIONS

Buildability is a concept that enhances the construction project performance and significantly contributes towards better value for money of a construction project. Against this background, it is surprising that very little thought or energy is given on incorporating buildability into construction projects' works stages which is expected to have the potential to significantly improve outcomes. Therefore, this study is designed to explore ways of integrating buildability in construction projects by making sense of deeper meanings of the key constructs buildability concept.

In this paper, the authors have made an effort to discuss the existing literature related to research methodology. Following a systematic approach from the research philosophies to the Research Approach, Research Methodological Choice, Research Strategy, Research Time Horizon, and Research Techniques and Procedures, a suitable research framework has been designed for this study. This is illustrated in Figure 3 above.

Through the discussion, the authors have argued that this particular research on obtaining a deeper understanding on buildability takes the phenomenological philosophical stance. Case study method as the most suitable research strategy. As way forward, it is envisaged to develop a detailed case study design for the research including particular micro-interactions and specific procedures to follow during data collection to grasp rich insights to the inquiry.

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